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Social cognition and emotion regulation: a multifaceted treatment (T-ScEmo) for patients with traumatic brain injury

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Abstract

Background: Many patients with moderate to severe traumatic brain injury have deficits in social cognition. Social cognition refers to the ability to perceive, interpret, and act upon social information. Few studies have investigated the effectiveness of treatment for impairments of social cognition in patients with traumatic brain injury. Moreover, these studies have targeted only a single aspect of the problem. They all reported improvements, but evidence for transfer of learned skills to daily life was scarce. We evaluated a multifaceted treatment protocol for poor social cognition and emotion regulation impairments (called T-ScEmo) in patients with traumatic brain injury and found evidence for transfer to participation and quality of life.

Purpose: In the current paper, we describe the theoretical underpinning, the design, and the content of our treatment of social cognition and emotion regulation (T-ScEmo).

Theory into practice: The multifaceted treatment that we describe is aimed at improving social cognition, regulation of social behavior and participation in everyday life. Some of the methods taught were already evidence-based and derived from existing studies. They were combined, modified, or extended with newly developed material.

Protocol design: T-ScEmo consists of 20 one-hour individual sessions and incorporates three modules: (1) emotion perception, (2) perspective taking and theory of mind, and (3) regulation of social behavior. It includes goal-setting, psycho-education, function training, compensatory strategy training, self-monitoring, role-play with participation of a significant other, and homework assignments.

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Recommendations: It is strongly recommended to offer all three modules, as they build upon each other. However, therapists can vary the time spent per module, in line with the patients' individual needs and goals. In future, development of e-learning modules and virtual reality sessions might shorten the treatment.

Keywords

Traumatic brain injury, treatment, social cognition, behavior, emotion regulation

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Introduction

Traumatic brain injury refers to a brain lesion caused by an external mechanical force, leading not only to physical impairments and cognitive deficits, but also to changes in behavior and personality.^{1,2} Especially after damage to orbito-frontal and ventromedial prefrontal brain areas, deficits in social cognition can occur.^{3,4}

According to Adolphs,⁵ social cognition consists of three stages: (1) the ability to perceive social information (i.e. emotional facial expressions, bodily language), (2) the capacity to process and interpret social information (i.e. theory of mind, perspective taking), and (3) the ability to adapt behavior in accordance with the situation. Babbage et al.⁶ estimated that 13%–39% of individuals with moderate to severe traumatic brain injury experienced emotion perception deficits and up to 70% reported low empathy.^{7–9}

Deficits in social cognition often appear in the shape of socially inadequate behavior, such as disinhibited or indifferent emotional behavior.^{10–12} Such behaviors have detrimental consequences for the ability of patients to establish and maintain social relationships, to hold jobs, and to participate in society.^{1,13,14} It has been found that poor theory of mind and behavioral problems significantly predict poor participation and community integration.^{15,16} For all these reasons, it is important to provide a tailored rehabilitation treatment, in order to prevent an unfavorable outcome.

In their review of cognitive rehabilitation, Cicerone et al.¹⁷ stressed the need to provide detailed information about the theoretical base, the protocol

design, and the ingredients of a treatment, as a prerequisite to analyze its effectiveness. In the current paper, we give a comprehensive description of the treatment of social cognition and emotion regulation protocol (T-ScEmo). The effectiveness of T-ScEmo was evaluated in 59 patients with traumatic brain injury. It was compared with a computerized control treatment in a randomized controlled trial.¹⁸ Compared to the control treatment, T-ScEmo resulted in significant improvements in emotion recognition, theory of mind, emphatic behavior, quality of life partner relationship, quality of life and societal participation, up to five months posttreatment. Patients with traumatic brain injury as well as their life partners were satisfied with the treatment.¹⁸ A detailed description of the T-ScEmo protocol is relevant for researchers and clinical therapists; they can use, replicate, or expand this newly developed treatment.

Treatment of social cognition and emotion regulation

Rationale

Lately, a growing number of studies have established that social cognitive information processing skills, that is, emotion recognition ability and theory of mind ability, can be linked to inadequate behavior following traumatic brain injury.^{12,19,20} Despite the complexity of social behavior, treatment studies aimed at improving social cognition after traumatic brain injury have only targeted single aspects of social cognition.

Four studies found that patients with traumatic brain injury were able to improve their ability

Table 1. Rationale and treatment ingredients of T-ScEmo.

Rationale	Treatment aims	Treatment ingredients
1. Adequate emotion recognition is a basic part of social information processing	Improve emotion recognition	<ul style="list-style-type: none"> • Facial-feature processing • Mimicry • Personal emotional experiences • Body language
2. Understanding and interpretation of social information precedes adequate social behavior	Improve Theory of Mind ability and perspective taking	<ul style="list-style-type: none"> • Perspective taking • Thoughts–feelings–behavior triangle (self, other) • Ask others about their thoughts and feelings • Attend to feelings of others
3. Correct understanding of social input/cues precedes adequate social behavior, but social behavior and consequences of one's behavior can be addressed directly as well	Improve awareness and inhibition of inappropriate social behavior Improve socially appropriate behavior	<ul style="list-style-type: none"> • Basic social skills training: personal space, listening, reflection of feelings (education, role-play) • Specific social skills training: registration of behavior to find precursors of anger (e.g. fatigue, confrontation with impairments), irritability and anger management, coping with conflicts and inappropriate behavior, social reasoning, positive social behavior (role-play, feedback counseling)

to perceive emotions following facial affect training.^{21–24} The studies that investigated the generalization of improved emotion recognition to daily life functioning did not find evidence for a transfer of learned skills.^{22,24} Only one pilot study reported reduced aggression following emotion recognition training.²³ The evidence for effective theory of mind training following traumatic brain injury is very scarce and limited to the treatment of general communication problems²⁵ or confined to case reports.²⁶ Social skills training for patients with traumatic brain injury focuses exclusively on behavior. It is based upon the assumption that patients lack well-defined social skills or knowledge that can be (re)learned. The modest improvements found after social skills training were limited to direct measures of behavior and did not generalize to societal participation.^{27–29}

We deem it likely that patients with traumatic brain injury can only benefit from such a social skills treatment when they are able to adequately recognize the social circumstances in which a particular social behavioral skill should be deployed. Therefore, underlying deficits in social information processing need to be addressed. Therefore, we took the stance that a comprehensive, multifaceted

treatment, targeting all aspects of social cognition, should be more effective.

Protocol design and procedure

The T-ScEmo protocol addresses emotion perception (module 1), perspective taking and understanding social information (module 2), followed by basic and goal-directed social behavior (module 3). The three modules are interdependent and strengthen each other, and training material is used in combination throughout the treatment (Table 1). Due to the complexity of deficits in social cognition, the presence of behavioral problems and additional relational problems, the qualifications of the therapist involved in this treatment protocol should be at the level of a (clinical) neuropsychologist. When in the subsequent text the term therapist is mentioned, we refer to this professional level.

Overall, the main focus of treatment is to teach patients the social strategies they need to tackle social difficulties in daily life, with the ultimate goal to maintain and improve social relationships and to participate in society. The approach is individual and includes self-monitoring and goal-setting. Generalization to daily life is fostered

through homework assignments. Since patients with traumatic brain injury differ greatly in their ability to learn and generalize, T-ScEemo is comprehensive and entails different levels of difficulty and control. Some patients, for instance, are able to use compensatory strategies independently, while others need continuous environmental instruction.

A significant other (preferably a life partner) participates intensively in the treatment. The objective of this involvement of significant others is (1) to enhance this persons' understanding of the impairments of the patient, (2) to teach him or her "assistant coach" strategies for everyday life (to foster patients' positive social behavior and restrict inadequate behavior), and (3) to improve and maintain the significant others' relationship with the patient. The presence of the significant other is required in the first psycho-education session and in the third module.

The first and second T-ScEemo modules are relatively invariant (10 sessions together). In the third module, therapists can choose from a broader set of materials; strategies can vary in complexity and content and can be adjusted to individual needs and personal goals (10 sessions). The three modules encompass a total of 20 sessions. Each session is structured as follows: first, the homework assignments are evaluated (5–10 minutes), after which the content of the current session is presented and practiced (for 45–50 minutes), and finally, a preview of the next session is given, with new homework assignments (about 5 minutes). This set-up, in which looking back and forward alternate, offers structure and is intended to improve insight.

During training, any sign of insight must be reinforced. For the therapist giving the training, it is important to take into account cognitive comorbidities (for instance, deficits in attention or memory). This is done through writing task and homework instructions in a workbook, repeating instructions when needed and checking that these are understood. Therapists familiar with the training need about 15 minutes of preparation time before each session, to print documents (i.e. information texts, material used in sessions, and homework assignments), read and prepare content and materials.

Eligible patients

Patients with impairments in social cognition and social behavior are eligible for this treatment. Impairments in social cognition are assessed with neuropsychological tests, measuring specific aspects of social cognition like emotion recognition, theory of mind, or social behavior regulation. Generally, such tests are not administered routinely as part of a neuropsychological assessment. A recent survey among 443 therapists worldwide has revealed that although they estimated that more than half of the patients with severe traumatic brain injury have social cognitive impairments, 78% still reported that they rarely or never assessed social cognition with standardized tests.³⁰

Impairments in social behavior can also be assessed using questionnaires that tap into aspects of social behavior, like the Dysexecutive Questionnaire³¹ or the Brock's adaptive functioning questionnaire.³² As patients with impaired social cognition are likely to have insight problems,¹² it is important to incorporate the ratings of patients' social behavior by significant others in the process of assessment. If social behavior is so severely affected that patients are in need for medication and/or a protective environment, T-ScEemo is too demanding and therefore not an appropriate treatment. Similarly, if neuropsychological examination reveals severe impairments in memory, language or perception that interfere with the patient's abilities to follow treatment and understand and use the T-ScEemo materials, the treatment is not feasible.

Materials

Psycho-education. In the first session, psycho-education is given to the patients with traumatic brain injury together with their significant others. Both parties are informed about the patients' neuropsychological functioning, previously assessed with tests and questionnaires. Impairments in social cognition and social behavior and their consequences for everyday life functioning are discussed. This to increase patients' insight and

treatment motivation. The concept of social cognition is often new for patients, but can be a helpful framework to understand their problems. It is explained that problems in social cognition are a common consequence of traumatic brain injury. The involvement of a significant other is important in clarifying problematic behavior to the patient, using examples from everyday life. In addition, three personal treatment goals are set. Per treatment goal, patients rate their current functioning on a visual analog scale from 1 to 10. A goal may for example be "I want to respond adequately to the feelings of my life partner."

Furthermore, the patient and the significant other are informed that (1) the treatment will be tailored to the patients' capabilities and needs, meaning that for some patients, the autonomous use of compensatory cognitive strategies is achievable, whereas others will need more help, (2) improving social and emotional behavior involves practicing new behaviors in daily life to accomplish generalization, (3) even if at first it may feel unnatural for patients and significant others to use new strategies in daily life, after training these newly acquired behaviors may become more automatic. However, (4) it is unrealistic to expect that the patient will function as adequately as before injury.

Module 1 (sessions 2–6): emotion perception. The general treatment goals of the emotion perception module are to improve the ability to recognize basic facial emotions, the signaling of two complex emotions "embarrassment" and "contempt," and the adequate detection of body language. Patients are taught three emotion recognition strategies. The aim is to offer the patient a set of strategies from which to choose (the most adequate one) or to combine two or more of these strategies. The strategies bear on (1) facial-feature processing, (2) mimicry, and (3) emotional experiences.^{23,24} Patients learn the strategies in the abovementioned order. When the patient is able to apply a strategy faultlessly, an additional strategy is taught while repeating earlier strategies.

In session 2, facial-feature processing is practiced. This training has shown its effectivity in

patients with traumatic brain injury^{23,24} and in samples with several other etiologies.^{33–35} In facial-feature processing training, the patient is instructed to pay attention to important facial cues (i.e. eyes, mouth, and nose) and to the overall facial expressions, in order to infer emotions correctly.^{22,23} Through the use of validated photographs, information is given about the facial cues for the basic emotions anger, fear, sadness, happiness, disgust, and surprise^{36–38} In the case of expressions of fear, for instance, it is pointed out that the eyes are wide open and the mouth is slack.²³ After this educational phase, the patient is asked to label emotional facial expressions in "EmotionRec." EmotionRec is a computer-based program with six exercises targeting basic emotions. Herein, several validated (both static and dynamic) basic facial emotional expressions are displayed.^{36,37} Participants are asked to identify these emotions and feedback is given after each response following several principles; cueing (i.e. arrow guidance on static facial pictures to increase attention directed to eyes and mouth), shaping (i.e. the therapist may verbally reward explicit facial cue naming that describes a correct emotion), errorless learning (i.e. the therapist provides feedback on cue calling and corrects when necessary), and vanishing cues (i.e. the gradual reduction of guidance and feedback).

Second, mimicry is used to improve facial affect recognition (session 3). Mimicry has been shown to be successful in improving the detection of others' feelings in a sample of people with traumatic brain injury and it provides cues about the nature of the emotions observed.^{22,39} Moody et al.⁴⁰ found that mimicry is not simply reflexive but leads to emotional changes in the observer. Thus, mimicking other people's emotional expressions may induce the experience of these emotions in the observer, which will enhance the recognition of these emotional expressions, suggesting an involvement of the mirror neuron system.⁴¹ Balconi et al.⁴² found that both the perception of facial affect and the contraction of facial muscles when expressing this emotion activated the medial prefrontal cortex (mPFC). Other studies have shown that obstructing facial mimicry leads to poorer accuracy in emotion perception^{43,44} whereas

exaggerated mimicry may provide experiential cues to induce emotion recognition. In the T-ScEmo protocol, patients are instructed to deliberately contract their facial muscles to mimic the picture of a facial emotion as close as possible (eventually with the help of a hand mirror). The therapist mimics the emotions together with the patient. EmotionRec is also used to display film vignettes with dynamic representations of facial emotions.^{36,37} Patients practice the mimicking strategy until they are able to shape their facial muscles adequately.

The third emotion recognition strategy involves the use of previous emotional experiences and the evocation of feelings that correspond to the facial emotional expressions displayed in EmotionRec (session 4). In neuroimaging studies, it has been found that the same brain areas are activated when individuals perceive others' emotions and when they experience these emotions.⁴⁵ There is also evidence that poor performance in an emotion matching task is related to a reduced ability to experience emotions following traumatic brain injury.⁴⁶ EmotionRec shows dynamic facial emotions, and after each picture, the patient is asked to describe examples from personal emotional events. Prior to this, the patients are asked to describe emotional feelings experienced before and after brain injury in a homework assignment. Basic emotions are addressed one by one. For every emotion, patients are asked to recount a personal emotional event, explain how they had felt, and specify the accompanying physical reactions elicited by this event.

Besides these three facial affect recognition strategies, in session 5, body language accompanying basic emotions is illustrated by the therapist using an information text with pictures.⁴⁷ Furthermore, the therapist role-plays body language in fictive situations, asking the patient to imitate this behavior.

In addition to the basic emotions, two secondary emotions, namely contempt and embarrassment, are practiced in EmotionRec (session 6). These emotions can express others' inconvenience in situations with inappropriate behavior.^{36,37} Patients use the already described strategies to improve the recognition of contempt and embarrassment signals.

In addition, they are asked about their own role in such emotional contexts. We think that increasing the sensitivity for others' feelings is the first step in the modification of inappropriate behavior. The detection of anger, contempt, or embarrassment in significant others may help in better monitoring ongoing behavior and in triggering adequate behavior (e.g. to make apologies).

Module 2 (sessions 7–11): perspective taking and theory of mind. This module has three objectives: (1) clarifying the concept of perspective taking, (2) explaining that other people may have different thoughts and feelings, and (3) illustrating that different viewpoints can coexist, thereby improving the understanding of others feelings and thoughts.

To attain these goals, we use principles from cognitive behavioral therapy. In session 7, a simplified thoughts–feelings–behavior (T-F-B) triangle is introduced to explain perspective taking.⁴⁸ This T-F-B triangle differs from traditional cognitive behavioral therapy in that it focuses only on explicit communication about thoughts and feelings (of the patient and others) instead of trying to reframe attributions or cognitive distortions. Patients are taught strategies to fill-in T-F-B schemes (see Figure 1), with a “self” and an “other” column. This is practiced using hypothetical and real-life personal conflicts asked for by the therapist and in homework assignments. The “other” column is used to prevent mindreading or jumping to conclusions about others intentions, motives, or behavior. The objective of the T-F-B scheme is to explain that our own intentions, perspectives, and intentions may differ from those of other people.

In session 8, real-life film vignettes are used, in which several emotional situations are shown. Several pre-programmed questions are asked after the videos. These questions are aimed at rehearsing emotion recognition strategies and at facilitating perspective taking (through the use of the T-F-B triangle) and the understanding of behavior. The patient is taught to address four important questions: (1) How will the other *feel*?, (2) What will the other *think*?, (3) How can I *influence* the other? (i.e. remark, posture, behavior), and (4) How will the other *respond*?




	Self	Other
 <p>Thoughts</p>	3. What thoughts do I have in the situation?	6. What thoughts apply to the other person in the situation?
 <p>Feelings</p>	1. What kind of feelings do I have in the situation?	5. What kind of feelings apply to the other person in the situation?
 <p>Behavior</p>	2. What kind of behavior do I show?	4. What kind of behavior does the other person display?

Figure 1. Thoughts–feelings–behavior scheme (module 2).

Session 9 is about empathy, a concept explained using the T-F-B triangle. Through role-plays, the therapist illustrates empathic and non-empathic reactions. In session 10, contradictory social information (i.e. sarcasm, lies, and jokes) is analyzed and the session includes role-plays intended to practice and reflect upon contradictory communication in everyday life.

For session 11, the presence of a significant other is required, since it includes an evaluation of the patients' and significant others' treatment experience so far. The therapist stimulates treatment motivation by offering positive, but realistic feedback (e.g. compliments for treatment adherence, homework quality). Furthermore, this session includes the repetition of earlier strategies.

Module 3 (sessions 12–20): social behavior. The treatment goals of the Social Behavior module include the improvement of self-awareness, a better inhibition of inappropriate social behavior, and the improvement of socially desired behavior. All patients are taught basic social skills (sessions

12–14), to handle basic communication conditions and inhibit inappropriate communication. After that, the focus of treatment is narrowed down to individual behavioral problems in everyday life (sessions 15–20). The sessions can be adjusted to patients' goals, capacities, and needs, with varying levels of complexity. In this module, role-play, involving the therapist and the patient, is used extensively and for sessions 13, 14, and 18, the presence of a significant other is also required. This last module builds on the previous modules, in targeting emotions and cognitions of others (attention to facial expressions, T-F-B triangle) and in tackling the consequences of one's own behavior for others.

The third module starts with a basic social skills training (sessions 12–14), in order to teach patients adequate communication principles and to learn them how to inhibit inappropriate behavior. In session 12, patients learn how to respect others' personal space. It is explained what is meant by "appropriate distance" to familiar and unfamiliar people. Session 13 includes active listening, such as task concentration practice⁴⁹ and conversational

turn-taking. It contains a role-play, with the therapist being too talkative, wherein the patient is taught to appropriately ask for more structure. The reflection of feelings is rehearsed in session 14 via the therapist and a significant other by modeling and role-play. This is taught in varying degrees of complexity, ranging from general "Can you tell me how you feel?" to more specific "Are you happy?" to "It looks like you are tired, can I do something for you?" In this module, materials from a social skills training and a social anxiety training^{49–51} are used in an adapted form.

The specific goal-directed behavioral part of T-ScEmo (sessions 15–20) includes the improvement of social reasoning, the enhancement of self-insight and self-efficacy, the detection of precursors of inappropriate behavior, coping with conflicts and feedback, anger management, followed by positive behavior and the stimulation of social activity. Session 15 starts with social problem solving training (SPST), to stimulate social reasoning, to improve patients' insight in problem situations and to curb impulsive behavior. The SPST approach is defined as "the self-directed cognitive behavioral process by which a person attempts to identify or discover effective or adaptive ways of coping with problematic situations encountered in everyday living."⁵² The patient is asked to fill-out the SPST-scheme, adapted for the T-ScEmo protocol, to signal a problem, explore problems, decide on solutions and test, and reflect on behavior applied to solve the social problem.

Sessions 16a and 17a are optional. They target disinhibited behavior (if present), in particular anger and temper flares. In a risk-analysis, patients learn to recognize early physical signs of irritability and anger (e.g. muscle tension, increased body temperature). Also, through registration, patients learn to associate precursors (i.e. fatigue, inflexibility) with anger bursts. In a behavioral scheme (see Figure 2), this relation is made more explicit. Thoughts and feelings within the situation are phrased, as irritability may end up in anger in specific situations. The applied scheme is derived from a treatment for emotion regulation deficits in borderline personality disorder⁵³ and is complemented with an extra "cleaning" column. Patients are taught that if you

make a mess of social situations you have to clean it up (i.e. making apologies).

Sessions 16b and 17b have been developed to enhance positive social behavior and the quality of social relationships, as well as to prevent social isolation. Session 16b includes some basic principles for successful social contacts; what does it take to establish a friendship, where to meet other people, and how to initiate a conversation. Session 17b incorporates role-plays and incentives to increase positive behavior, value social contacts (i.e. compliments, appreciation) and strengthen or expand one's social network. Both sessions incorporate role-play and the application of the SPST.

Session 18 addresses the application and the reception of corrective feedback for both patient and the significant other. Both skills have proven effective in diminishing socially inappropriate behavior.⁵⁴ It is likely that behavioral (in)activation can be achieved by substituting inappropriate responses with more desirable ones through operant conditioning, modeling, and shaping.⁵⁵ This session includes role-plays to target inappropriate behaviors, such as being vulgar, talking too confidentially to strangers, or acting childishly. Patients learn that their behavior may influence others' T-F-B triangle positively (i.e. by showing appreciation, giving a compliment, or apologize) or negatively (i.e. by being egocentric, having emotional outbursts). The patient and the significant other choose and then practice the best behavioral solution to target inappropriate behavior. For example, significant others may learn to stop ongoing inappropriate behavior with general or specific feedback instructions (e.g. "Stop," "your voice is very loud, please take a time-out," "this is not a funny joke, you hurt my feelings").

In session 19, patients learn to cope with stressful emotional situations. They learn how to take an appropriate time-out, including (1) notifying that they leave, (2) move out, (3) go for a walk or for sports, (4) practice relaxation, and (5) return when they are easygoing again and when they know what to say when re-entering the situation.⁵⁶ These time-out steps are written on a cue card. Furthermore, significant others learn to stop ongoing inappropriate behavior through external


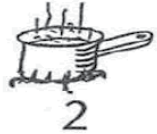


	 Calm	 Signs of irritability?	 Anger burst	 Clean up
Event	I'm working on the computer	I have made a few mistakes and it takes longer than I thought	My life partner enters the room notifying that someone is at the telephone	Later that day we drink tea
Thoughts	I want to finish this task	This confrontation is very annoying	Don't disturb me!	I have to make up for it / apologize
Feelings/ bodily signals	Good	Irritated, Headache	Muscle tension	Restless
Behavior	I'm working calmly	I keep on working	Bugger off!! Leave me alone.	I say: I'm sorry for my outburst this morning. I was overreacting. You don't deserve that.
Consequences	No	No	Life partner walks out angry	Life partner says: I'm glad that you say something about it. I do know that it is better to leave you alone at the study, but that is not always easy.
Influence impairments Fatigue	Fatigue (mild)	Fatigue (moderate)	Fatigue (severe)	Fatigue (mild)

Figure 2. Example of the behavioral scheme—from irritation to outbursts (modified scheme derived from a treatment for emotion regulation deficits).⁵³

cues (e.g. particular words, physical signals). Aids are included to inform others about one's behavioral impairments (e.g. cue cards, short replicable sentences).⁵⁶ Furthermore, this session addresses the ability to apologize when inappropriate behaviors occur.

In session 20, the T-ScEemo protocol is evaluated, with special attention for the individualized treatment content. The therapist completes a scheme with important insights, individualized strategies, and points of attention and repetition. The patient is asked to put this scheme in an eye-catching place to increase

Case report: Paul

Paul is a 55-year-old male with a moderate traumatic brain injury (since seven years). He was referred to rehabilitation with neurobehavioral dysfunction. Paul reported arguing with his wife daily. His wife reported Paul's self-centeredness, hurtful communication, irritability, angeriness, and an absence of affection and empathy. Paul had been able to resume his former job, but with lower demands. In his work (as a car dealer), he experienced difficulties in the negotiations with clients and he frequently behaved angrily toward his staff. Neuropsychological assessment revealed intact recognition of facial affect but poor perspective taking and the presence of behavioral problems (e.g. trouble controlling emotions with increased temper flares, poor empathy). Together with the therapist, Paul formulated three treatment goals: (1) I want to react appropriately to others' emotions, (2) I want to reduce my hurtful and blunt behavior, and (3) I want to better control my temper flares.

Guided by T-ScEmo, Paul and his wife received psycho-education based on his neuropsychological profile. In the emotion perception module, it became clear that although Paul's emotion recognition skills were not impaired on test level, he did not pay adequate attention to feelings or facial expressions in real-life. When stimulated to attend to others' facial emotions, his recognition of emotions was sufficient. At first, he found this intensified attention to social information exhausting, but as the treatment proceeded it took him less energy. Paul noted that he functioned better in his job, and that he was able to perceive customer signals again. In the second module, Paul became aware that he had difficulties considering the opinions of others' and to stand in their shoes. However, he considered his marriage as still important and was therefore motivated to reduce disagreements and fights. By means of the T-F-B scheme, he was encouraged to check his wife's thoughts and feelings, a first step in better understanding her. At some point, he practiced the same skill with his adult children as well. His wife participated in the role-plays, which were emotional but very important in clearing up miscommunication and distress. They started to schedule "talk-moments" at home, an important investment step in their relationship. In the third module, the association between fatigue and his anger bursts became apparent. Paul reduced his daily to-do list into smaller subtasks, with several rest moments in between, to prevent fatigue (and herewith reduced his anger bursts). Furthermore, Paul informed his staff about his social cognitive and behavioral problems. He apologized for his angry behavior and discussed about solutions to diminish task switching moments (e.g. schedule an appointment instead of dropping by in his office). He also learned to introduce a functional time-out to cope with his anger bursts. His wife changed her behavior as well. She learned to express her feelings and expectations more explicitly and did not always wait for him to come up with questions or moments of affection, but started these independently.

After treatment Paul was able to attend to his wife's feelings and he was able to join business meetings and negotiations without temper flares. One year after treatment, the therapist received an email from Paul's wife. "I would like to thank you for my 'new husband', the metamorphosis is absolutely fantastic. We enjoy it every day. Paul is more understanding, lovable and caring. Looking back, I was married with three husbands; the first before the car accident, the second after the accident and the third after T-ScEmo. The first I simply loved. I didn't understand the second at all. We had a lot of arguments; it seemed that he didn't care at all about me, our children and our financial situation. He was egocentric, easily irritated and angry. I felt so lonely. The third is understanding and caring; a brand new one. The treatment helped to clarify our daily struggles. His awareness increased and he is trying hard to compensate for his deficits. I feel better equipped to deal with his behavior. Of course, cognitive problems are still present (i.e. memory impairments, fatigue) and it is not always easy, but we have learned to communicate about our feelings and we can support each other. A couple of years ago I thought we would end-up divorced, but now we can deal with the situation. We live our life and it is great again."

the chance of using it and to support transfer to everyday life functioning (see case report for an example).

Discussion

The purpose of this article was to describe in detail the protocol of a treatment of social cognition and emotion regulation (T-ScEmo) that has proven its

effectiveness in 59 patients with traumatic brain injury participating in a randomized controlled trial.¹⁸ T-ScEmo consists of 20 one-hour individual sessions complemented by homework assignments and incorporates function training (i.e. emotion recognition) and the use of individualized compensatory strategies (i.e. emotion recognition, theory of mind, social behavior). Furthermore,

a significant other participates in four treatment sessions, where he or she is taught "assistant coach" skills.

The effectiveness of T-ScEemo was investigated in patients with traumatic brain injury in the subacute and chronic phase. All these patients had social cognitive and behavioral problems. Patients with neuropsychological impairments that would seriously hamper the understanding and application of treatment strategies were excluded. In particular aphasia, agnosia, amnesic disorder, or physical aggressiveness interfere negatively with the understanding and application of treatment strategies. Such patients do not benefit from this treatment, because it is too verbal and using the strategies requires considerable learning potential.

Ideally the T-ScEemo treatment should start when the patient with traumatic brain injury is psychologically stable (i.e. mood, adaptability). The treatment was evaluated in patients in the subacute and chronic stage of recovery, with a large post-onset range. Patients may benefit from this treatment even years after injury. However, since the treatment is aimed at improving social and intimate relationships, it is advisable to offer this treatment timely, that is, before these relationships are damaged beyond repair.

Offering psycho-education is very important for patients and their significant others to understand the social cognitive and behavioral problems that they encounter in everyday life. Psycho-educational treatment is based on an extensive neuropsychological assessment, including tests for cognitive impairments (i.e. attention, memory, and executive functioning), supplemented by specific measures for social cognition and behavior (i.e. emotion recognition, theory of mind, emotion regulation, social monitoring, and empathy). Many patients with traumatic brain injury start T-ScEemo with a minimal awareness of their problems. According to Ylvisaker et al.,⁵⁷ it is very difficult to teach social skills to these patients, because they may lack the necessary motivation to change due to indifference or poor insight, or they may encounter difficulties in transferring newly learned skills to real-life. The therapist should take both cognitive and motivational difficulties into account and reinforce every sign of

appropriate behavior, while attempting to adapt to the deficits and the compliance of the patient. To overcome difficulties in motivation and insight, we include real-life examples of social cognition problems in our treatment, continuously emphasize the overall treatment goal which is to preserve social relationships, and include the participation of a significant other. This significant other plays an important role in the treatment. He or she contributes to the enhancement of insight and improves social behavior by offering corrective feedback in role-plays and real-life situations. In role-plays, the burden and needs of the significant other are discussed as well. This reciprocal communication increases insight, ameliorates the reflection of feelings, and offers opportunities to practice empathic behavior. Given the low drop-out rate in our randomized controlled trial, we conclude that gaining control over one's behavior in social situations, together with the experience of positive interactions, improves the internal motivation of the patient to adhere to the treatment. There appear to be several advantages associated with the use of the T-ScEemo protocol. These advantages include the availability of a standardized treatment protocol that allows replicability and the possibility to train and improve the patient's unique pattern of deficits through varying levels of treatment complexity. Last but not least, significant others' participation introduces real-life interactional situations and supports generalization to daily life. A number of concerns need to be addressed in future studies. Given our research question, the use of a multifaceted treatment was needed and justifiable. However, we acknowledge that within such a design, the effectiveness of the separate treatment ingredients cannot be established, since multiple treatment elements are used in conjunction, probably strengthening each other. In future studies, the first module can be studied in isolation with an independent evaluation between the first and second modules. In addition, future studies may deal with the reduction of treatment costs by developing e-learning modules and virtual reality sessions.

We strongly recommend applying all modules, as they build upon and strengthen each other. The case study illustrates this point. Patient Paul had no deficit in emotion recognition when only test scores were

considered, but in daily life, he did not pay attention to emotional signals. The first module was an important prerequisite to benefit from further treatment aimed at targeting his socially dysfunctional behavior. In clinical practice, this can easily be missed when only deviant test scores are taken into account. Furthermore, it would be interesting to gain insight into the characteristics of patients who benefit most (and least) from T-ScEmo. This could lead to a more tailored rehabilitation protocol that justifies (or even shortens) the intense treatment trajectory presented here. It may also be of interest to study the effectiveness of T-ScEmo in adolescents, or other patient populations (i.e. stroke, brain tumor). The broad-spectrum treatment ingredients might be also useful for other types of patients with acquired brain injury, provided that they have deficits in social cognition and associated behavioral problems.

Clinical messages

The multifaceted treatment approach T-ScEmo with a focus on social cognition and emotion regulation for patients with traumatic brain injury includes the following:

- Psycho-education and the development of awareness.
- A patient- and family-centered approach.
- Focus on three personal goals.
- Function training and compensatory strategies.
- Behavioral modification and social skills training.
- Practice translated to everyday life social situations.

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Supplemental material

Supplemental material for this article is available online.

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